

Routing Protocols in Hybrid Wireless Networks – Survey

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Abstract - The benefits of Mobile Ad Hoc Networks (MANET-Infrastructure less network) and cellular networks (Infrastructure network) are integrated which is termed as Hybrid Wireless Networks (HWN). Various routing schemes were proposed to investigate the hybrid wireless networks with the parameters such as throughput, QoS, packet loss, overhead (due to traffic), channel quality, load balancing, routing delivery, scalability and power consumption. HWN uses multi-hop routing techniques to forward the packets to the destination node from the sender, foremost the source node needs to select the relay node (among the neighbor nodes, it can be either Base Station (BS) or Mobile Node (MN)) which acts as an intermediate node based on the constraints of a node such as bandwidth acquire, capacity and load balancing through broadcasting the packets to nearby nodes.

Keywords: Hybrid Wireless Networks, QoS, MANET, Access points, Relay.

I. INTRODUCTION

The wireless network has of 2 different types, one kind of network is Base Station oriented wireless network (BS) and on other hand Ad hoc wireless network (Ad- Hoc). A Hybrid wireless Network (HWN) that integrates both Mobile Ad Hoc network and cellular infrastructure network. It is proven to have the best network forum for the next generation networks. According to the environmental condition, it acts as a Base Station (BS) and Ad Hoc. MANET has become highly popular due to its wide range of user satisfying services. The connection between two nodes via Access Points (APs) is carried out. The mobile nodes are free to move randomly due to frequent Network Topology changes. The challenges faced in MANET are of capacity, bandwidth and weak connection, where as in Cellular network, the mobile nodes have a direct link to communicate with the base station and behave as a non-autonomous manner. It leads to poor communication in case of more usage of an allocated channel in a particular cell. The major challenges faced in cellular network are of Handoff management and BS failure due to congestion overhead. A drawback of poor communication and weak connection has been overcome by hybrid wireless networks. HWN incorporates major features which are of more reliability, load balancing, better performance and high scalability. The main purpose of this paper is to review the work on yielding high throughput by enhancing efficient routing algorithm.

II. RELATED WORK

Takahiro Fujiwara, Takashi Watanabe [1]. During an event of disaster there doesn't exist any network communication to share the incident information and surrounding situations. In order to recover from the problem, the author proposed an efficient routing protocol. It gathers the hazardous damages so rapidly and quickly. Thus the routing protocol was designed to perform unicast communication by connecting the wireless (Ad hoc) network and cellular network which is named as ECCA (Enhanced Communication scheme combining centralized and Ad hoc networks).

During the event of disaster causes, the BS and Mobile Node can't be connected, thus the needed node is switched to the mode of Ad hoc. Therefore the node can access the BS by interacting with the neighbor nodes, which passes by multi hopping.

A Proposed routing protocol uses the shortest path to discover and builds a route by nearby nodes through communication and forwards the packet in CCCH (Common Communication CHannel) to inform the BS of the nodes status information, instead of broadcasting a route request packet in unicast communication manner.

To maintain the network, a dedicated medium access control (MAC) protocol based on TDMA is used to yield a less delay. A node operates in a cellular mode is termed as Direct Connection Network (DCN) and a node operates in an Ad hoc mode is termed as Indirect Connection Network. The Estimated parameters are direct connection node which is a ratio of no. of directly linked nodes to the total no. of available nodes in the cell, throughput, delays and reachability ratio. Thus an experimental result stated as 90% is calculated for reachability within the three hops, when the DCNR is 20%. But it fails to address the throughput efficiently.

Shawn chen et al [2] proposed a locality aware peer-to-peer (P2P) based on an approach for geospatial web spatial Discovery which works on spatial hash indexing to conserve the information. In this system the user joins and leaves from it independently due to an effective approach of P2P. The web Catalog Services (CS/W) server served the functionalities by discovering the services to the users indirectly whereas a P2P - System connects the user to the services directly. It is build for a network considering as dynamic, scalable, unstructured and decentralized web service registry in nature. It also provides a better load balancing. Finally the system security needs to be provided to sufficiently work on it.

Asha P. Rajapurohit et al [3] proposed a QoS - oriented data transmission technique; it provides the high quality based QoS in HWN by reducing the delay of transmission of data packets during interaction. An aim of QoS – oriented data transmission technique is used to convert from packet routing problem into a dynamic resource scheduling problem when a user doesn't available within the coverage area (i.e. AP – Access Point) range. There by, the source node selects the neighbor node based on the considerable factors such as bandwidth, delay due to noise and interference to transmit the data to the Base Station (BS) and further forwarded to the destination (to attain a QoS – guaranteed transmission). By using a technique, it recovers the race condition problems and invalid reservation problems. Finally to improve the QoS in a highly dynamic system contains the backbone (i.e.) packet scheduling algorithm for selecting the neighbor nodes and packet resizing algorithm to maximizes the scheduling of the intermediate nodes. Thus also achieves the high throughput in Hybrid Wireless Networks.

K. Anandkumar et al [4] aimed to improve the network throughput in Wireless Mesh Networks (WMN) where each node act as a router to choose the next neighbor to forwards the data to reach the destination of dynamic changing topologies. It takes places an algorithm in order of 1st version – Basic Algorithm Implementation, 2nd version – cliques in alphabetic order and 3rd version – produces the larger cliques. Thus the EPBW (Expected Path BandWidth) routing protocol is designed for performing route discovery, route calculation, route maintenance, route recovery based on Bron-kerbosch's algorithm and clique bandwidth functions. The steps follows in routing algorithm are 1. Calculate SNR of the RREQ packet received 2. Find the link quality using the smoothened SNR method 3. Calculate the EBW of the link according to the monitored link idle probability 4. Find the route that has the maximum link quality and transmit data. The parameters was calculated are of channel quality, load aware routing delivery ratio, packet loss ratio, delay, throughput. But it fails to investigate the load balancing and end to end delay.

Christian Gottron , Raif Steinmetz et al. [5] proposed an architecture by combining a MANET underlay (building a network at the application layer on top of an existing network) with a Distributed Hash Tables (DHT) overlay (Peer form a network) to provide a service when a mobile node doesn't applicable in the range of cellular networks for communication. The architecture connects /controls the clusters node and location awareness by their appropriate location. It follows the OLSR protocol extension called ETX (Expected transmission count) for –achieving the high throughout rather than hop distance and routing table calculation. To evaluate the clustered approach, the focused tasks were improved such as

1. Lookup operation which how an MP2P network is efficient on retrieval & availability of data objects.
2. Minimizing the overhead – by fixing the strongly limited bandwidth.

Yuan Sun, Elizabeth M. Belding-Royer [6] Proposed the two routing scheme are Mobile IP protocol & AODV protocol as combined in manner for improving the network performance with lower latency and also yielding low control overhead and higher throughput. To extend the coverage of the Ad hoc network to infrastructure wireless network. It establishes the access to routing approaches for hybrid network. The Gateway /FA Discovery- to access the internet, the mobile node needs to have the mobile IP and discover multi –hop path to foreign agents for communication to attain it.

1. The performances metrics are estimated based on web applications on average no. of session requests, mobile IP overhead, AODV overhead and total control overhead.
2. Effects of different Traffic locality are measured for energy consumption of the network, packet delivery ratio, normalized AODV and mobile IP overhead.

Haiying shen, ze Li, Chenxi Qiu. [7] Proposed a DTR (Distributed Three –hop Routing protocol) to Hybrid Wireless Networks. In this protocol data messages divided by segments and transmitted simultaneously to the widely spreaded Base Station (BS) to achieve the throughput and makes use of spatial reuse by the high speed Ad hoc interface and mobile gateway congestion by cellular interface. DTR has a controlling algorithm for congestion to eliminate Base Stations overhead and also eliminates the route discovery and maintenance by reducing overhead due to short path lengths. It chooses the relay mode which has a higher capacity node.

Vijay Raman, Nitin H. Vaidya. [8] The technique overcomes the delay circumstances in real time applications such as interactive gaming, VoIP. An above delay occurs due to the hardware and software limited constraints. In order to have network connectivity, an existing work was implemented that rely on channel switching capability of wireless radio (Multichannel Wireless Network). Thus the scheme proposed as a Static- Hybrid approach for routing Real Time application over multichannel, multi hop wireless networks (SHORT) to overcome the delay by low delay paths for an applications e.g., VoIP. The protocols used in SHORT are channel reselection mechanisms, multi channel routing protocol, it doesn't affect the throughput performance and provides best controlled traffic management due to TCP co-exist in a network.

R.Lakshmi Prabha G.Ganesan. [9] Here the proposed method focuses on effective file sharing by query operation in P2P mobile Ad hoc network. The Distributed routing protocol DSR and AODV protocols were used for transmission of file in a routing path. It overcomes the drawbacks of file query operations. An existing problem of file sharing is affected due to several properties of MANET which are of Mobility, bandwidth limitations, more energy consumptions, resource allocation to each of the nodes and limited communication ranges. Due to mobility, delay arises dramatically and also affects the message / file availability of the nodes. Therefore the proposed system reduces the delay by increasing the cache size. To attain a secure cooperative cache, the data processing delay period need to be reduced. In order to overcome an overhead of copying a data between user and kernel space, an approach of asymmetric is proposed. A connection establishes from a source to destination in a P2P MANET for ensuring the security in an authenticated routing path with the help of Diffie Hellman Digital Signature Scheme.

Yong Ding, Kanthakumar Pongaliur et al. [10] proposes a hybrid multichannel multiradio wireless mesh networking architecture. The Channel Allocation (CA) plays a vital role for avoidance of congestion overhead in the network. Thus the strategy follows in both static and dynamic channel allocation. In static CA, a channel is permanently allocated to each interface of every mesh routers. So it attains a low overhead. The traffic patterns are well defined and stable in structure. In dynamic CA, the channel switched from one to another. So it is unpredictable, due to the frequently changes in traffic pattern. In this paper both static and dynamic interface approaches were combined to acquire flexibility. The static link provides high throughput where as the dynamic link ensures the network connectivity and affordability for changing pattern of network due to network. Various algorithms were incorporated to avoid issues such as,

1. Multichannel MAC protocol - CA for dynamic interface.
2. ADCA protocol – to reduce packet delay without humiliating the performance of network throughput.
3. TDMA – it is used to share the frequency channels to many users by segmenting the signal ratio into many time slots and also transmits the data rapidly.
4. HMCP (Hybrid MultiChannel allocation Protocol) – to provide a less delay.
5. ICAR – it is a proposed protocol of this paper for balancing the channel usage and also improves the throughput.

In hybrid multichannel multiradio wireless mesh networking architecture, each mesh router uses an interface to adopt static and dynamic configuration of nodes in a network. An Adaptive Dynamic Channel Allocation (ADCA) protocol and an Interference and Congestion Aware Routing (ICAR) protocols were used to achieve less packet delay. It also improves the throughput and channel assignment. Finally it maximizes the network connectivity. Through a gateway, the user node takes up either a static link or dynamic link to reach destination node from a source node.

A P2P – based Market guided distributed routing mechanism for high throughput hybrid wireless networks

Haiying Shen, Ze Li, Lei Ya [11]. Proposed a mechanism of a P2P based market guided routing technique for improving the performance of throughput by avoiding the problem such as route discovery and route maintenance.

An existing system of this paper, simply combines the various routing schemes which induce the congestion and overhead problems at Ad hoc routing protocols. In this system, the nodes were deployed as per the given coordinates and by the way broadcast/flood the messages to each and every of its neighboring nodes. The distance of the neighbor nodes will be calculated according to the distance formula. The Base Stations were deployed in the center of all the nodes (i.e. Base Stations will act as a cluster head while processing). During processing the BSES will communicate with each other. In this process MDR is not used thus it attains a heavy packet loss, an efficiency of routing is less and also the nodes consume more energy for transferring the packet from source to destination.

The proposed MDR mechanism utilizes the widespread BSES for yielding an efficient data routing, TMM (Trading Market Management) and reputation management. MDR have 4 components

1. Trading Market Management (TMM)
2. Distributed Routing Algorithm (DRA)
3. Locality aware P2P-based infrastructure (LP2P) and
4. Efficient and Accurate Reputation Management (EARM).

A LP2P is used to support a reliable operation by providing the structure of P2P on the component of the network. An efficient and accurate reputation management relies on LP2P to collect the locality information of the nodes rather than using an existing reputation system which contains only an exchange of local informations. EARM is used to evaluate each of the nodes reputation values based on the nodes relayed messages. The feature of DRA is to take the single-relay for transformation of messages. In DRA, the source node transforms the segments to nearby node to select the relay node in a distributed scenario of nodes. To select the relay node, the source node broadcast the message/segment to neighbor nodes. The neighbor nodes which had a capability to reply back to source node that takes up the position as relay node (based on the strategies of EARM and TMM). The relay node sends the segment to its BS (Base station). The BS forwards the packet to the destination mobile nodes BS. In order to find the destination BS, the DTR is used. TMM looks for data transmission, thus ensures an efficient and reliable forwarding of packets by calculating service price. The service price was determined by supply and demand equilibrium status reported by each of the relay nodes.

III. CONCLUSION

In this paper, the various routing protocols and mechanisms are discussed. Different existing techniques have been employed for improving the throughput by reducing the delay, prevention of traffic and overhead at base stations. This survey paper analyzes the different algorithms for efficient routing, Quality of Services and cluster formation. It summarizes the accuracy and performance improvement of using Hybrid Wireless Networks.

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